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CSIR NET - GENERAL APTITUDE

QUANTITATIVE APTITUDE

L-7

SPEED TIME DISTANCE - I

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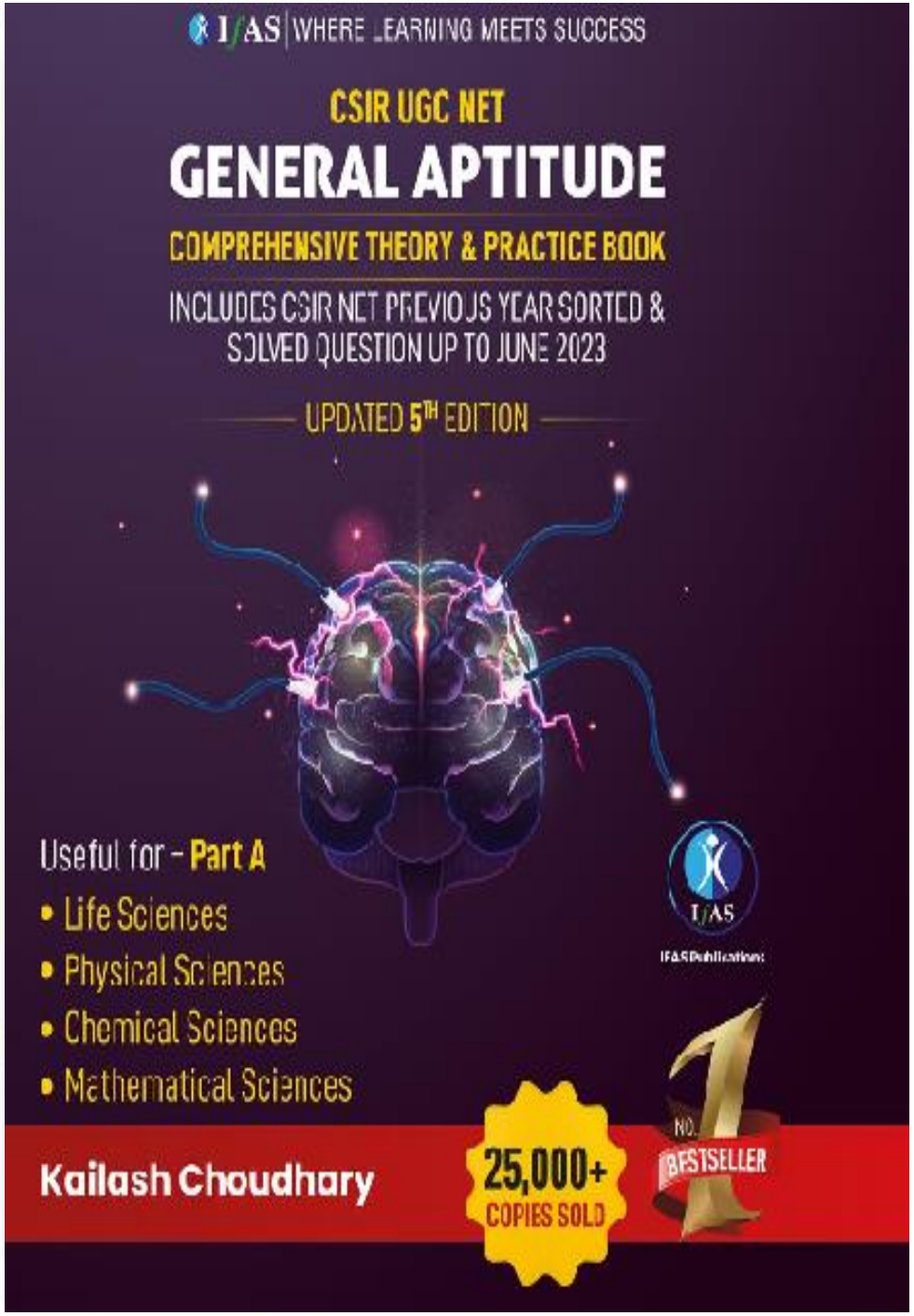
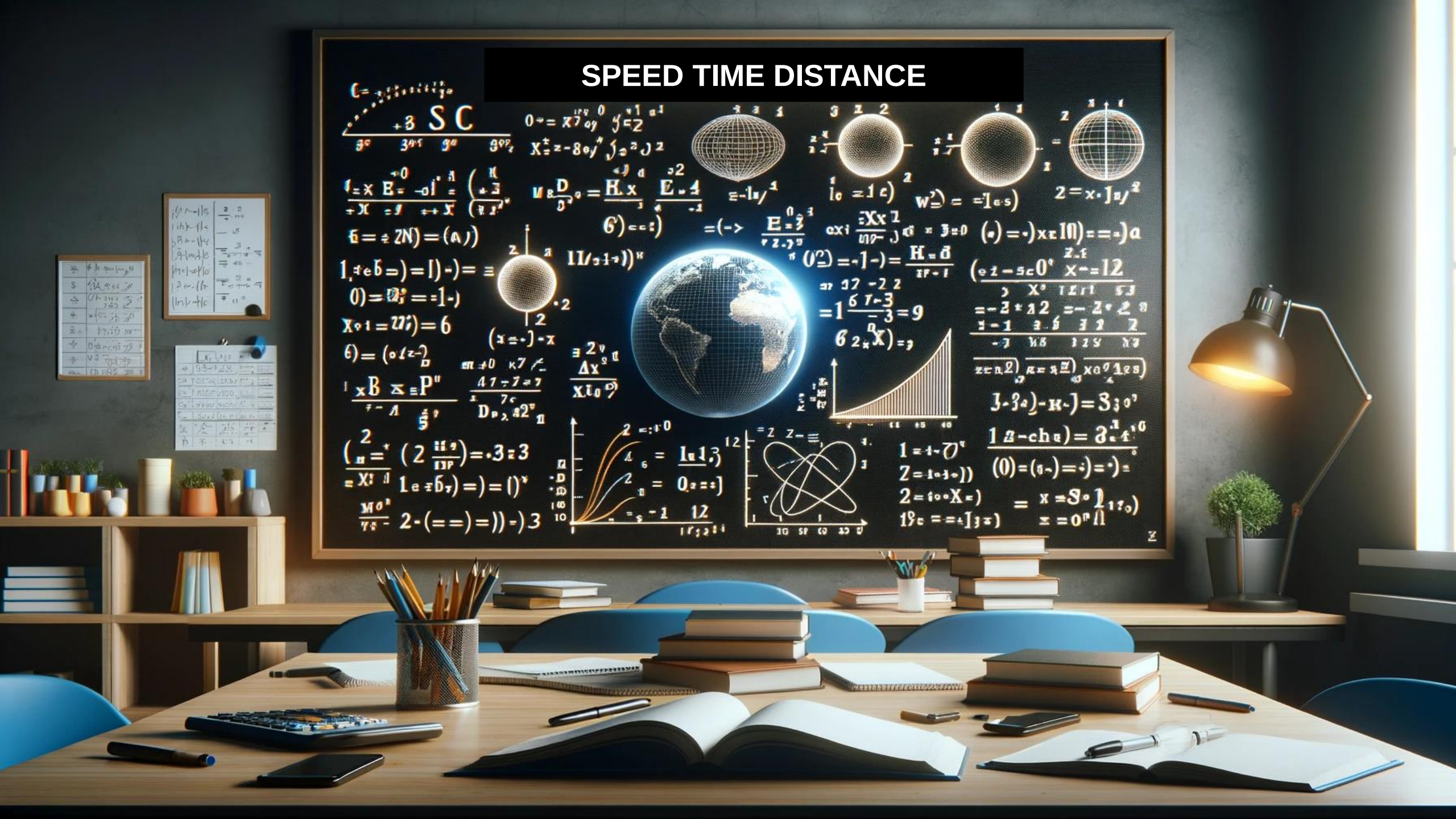


Topic Covered in Today's Session

1. What is speed ?
2. Unit conversion imp
3. Train based concept
4. Average speed
5. Relative speed
6. Practice questions


SPEED TIME DISTANCE

What is speed ?

Speed of an object is the distance covered by it in a unit time interval.

Speed = $\frac{\text{distance}}{\text{time}}$

Unit

$\frac{\text{Km}}{\text{hours}} \Rightarrow \text{km/hr}$

$\frac{\text{meter}}{\text{sec}} \Rightarrow \text{m/sec}$

Unit conversion

i. To convert speed from km/hr to m/s

A km /hr = (A x 5/18) m/s.

$\times \frac{5}{18}$

72 km/hr $\Rightarrow$ 20 m/sec

$72 \times \frac{5}{18} = 20$ mps

ii. To convert speed from m/s to km/hr

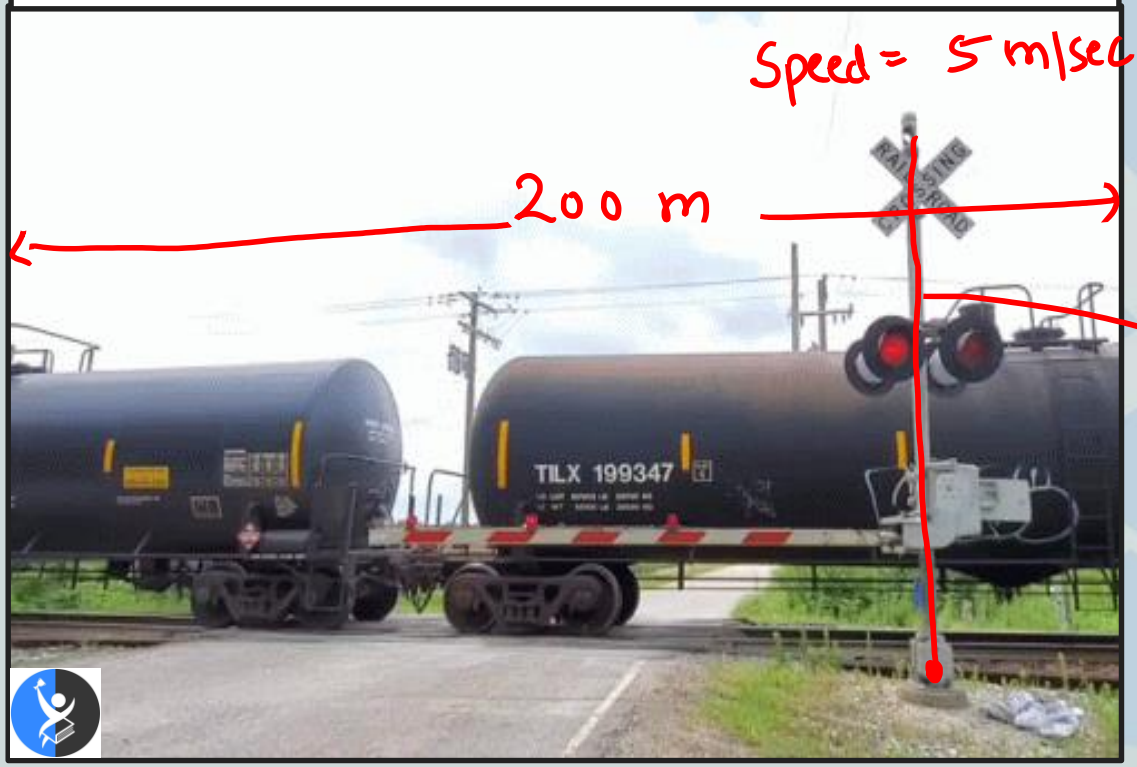
B m/s = (B x 18/5) km/hr.

$\times \frac{18}{5}$

25 m/sec $\Rightarrow 25 \times \frac{18}{5} = 90$ km/hr

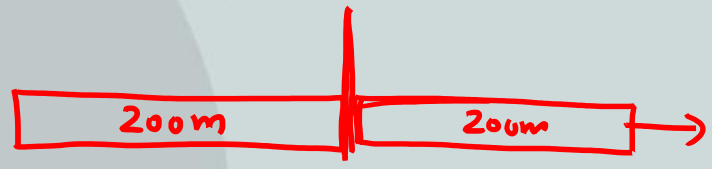
Train based concept

Train crossing an electric pole:



Pole
Tree
Man / Person

[d = length of the train = 200m



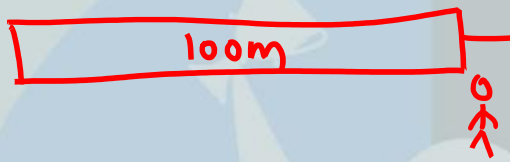
$t = \frac{d}{S} = \frac{200}{5} = 40$ sec

Train crossing a bridge: ⊛

$$d = \text{length of train} + \text{length of bridge}$$
$$d = 200 + 100 = 300\ m$$

Q1. A train 100m long is running at the speed of 30 km/h. Find the time taken by it to pass a man standing near the railway line.

1) 12
2) 10
3) 9
4) 18



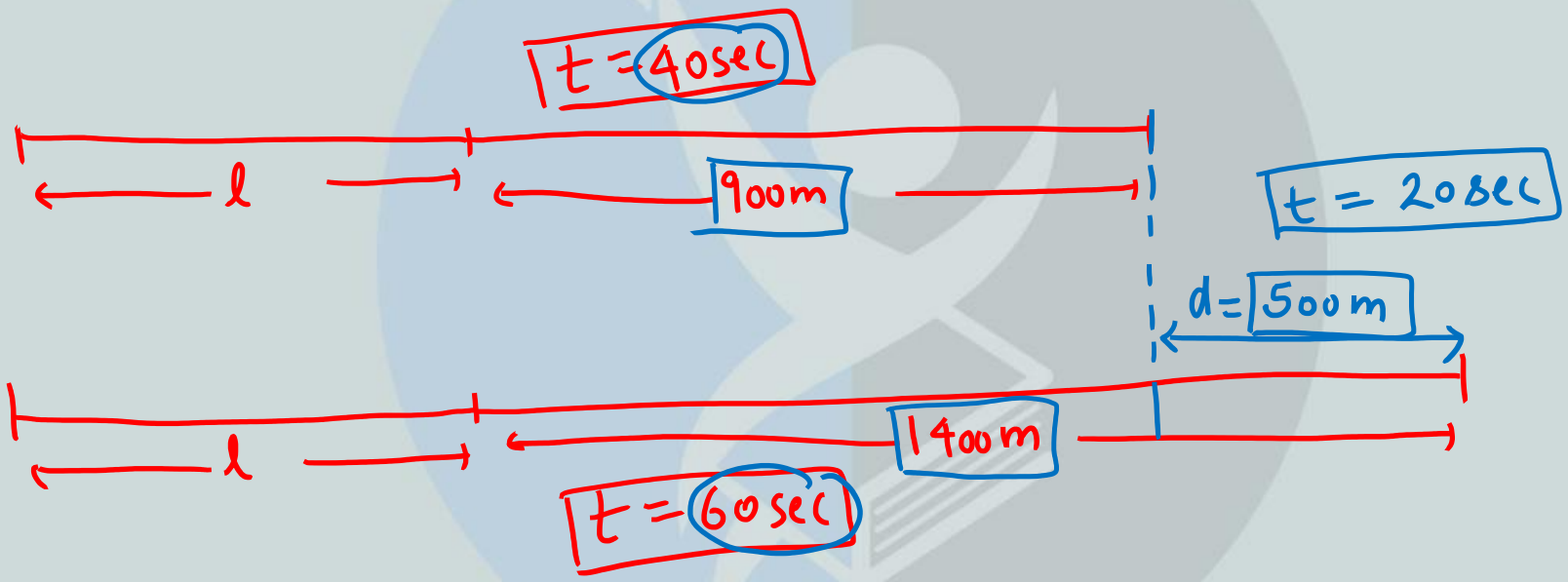
$$\Rightarrow 30 \times \frac{5}{18} = \frac{25}{3} \text{ mps}$$

$$t = \frac{d}{s} = \frac{100 \times 3}{25} = 12 \text{ sec}$$

Q2. A train crosses a bridge and a platform of length 900 m and 1400 m in 40 sec and 60 sec respectively. Find the speed of the train.

(a) 25 m/s(b) 26 m/s(c) 25.5 m/s (d) 27 m/s

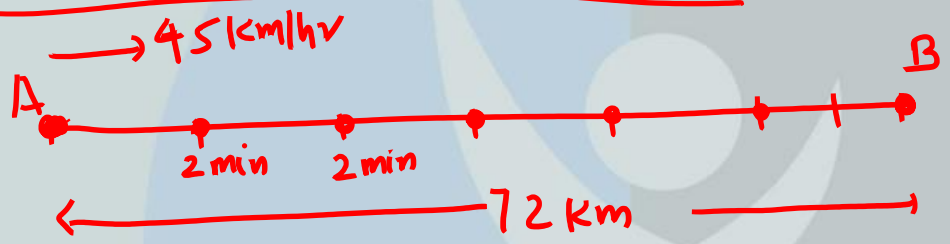
$S = \frac{500}{20} = 25$ mps



Q3. A metro train runs at a speed of 45 km/h. It covers a total distance of 72 km on its route from origin to destination station in 2 hours that includes stops at intermediate stations. If it stops for 2 minutes at each station, how many intermediate stations are there in the route?

PYQ (Dec 2023)

1. 24
2. 18
3. 12
4. 9



120 min

t = 2 hours

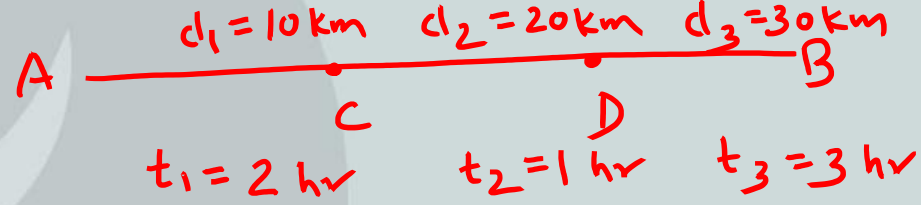
$$t = \frac{d}{s} = \frac{72}{45} \times 60 = 96 \text{ min}$$

Extra time = 120 − 96 = 24 min.

No. of stations = $\frac{24}{2} = 12$

Average Speed

The average speed of an object is the distance travelled by the object divided by the duration of the interval.



Average Speed = $\dfrac{\text{Total distance}}{\text{Total time interval}}$

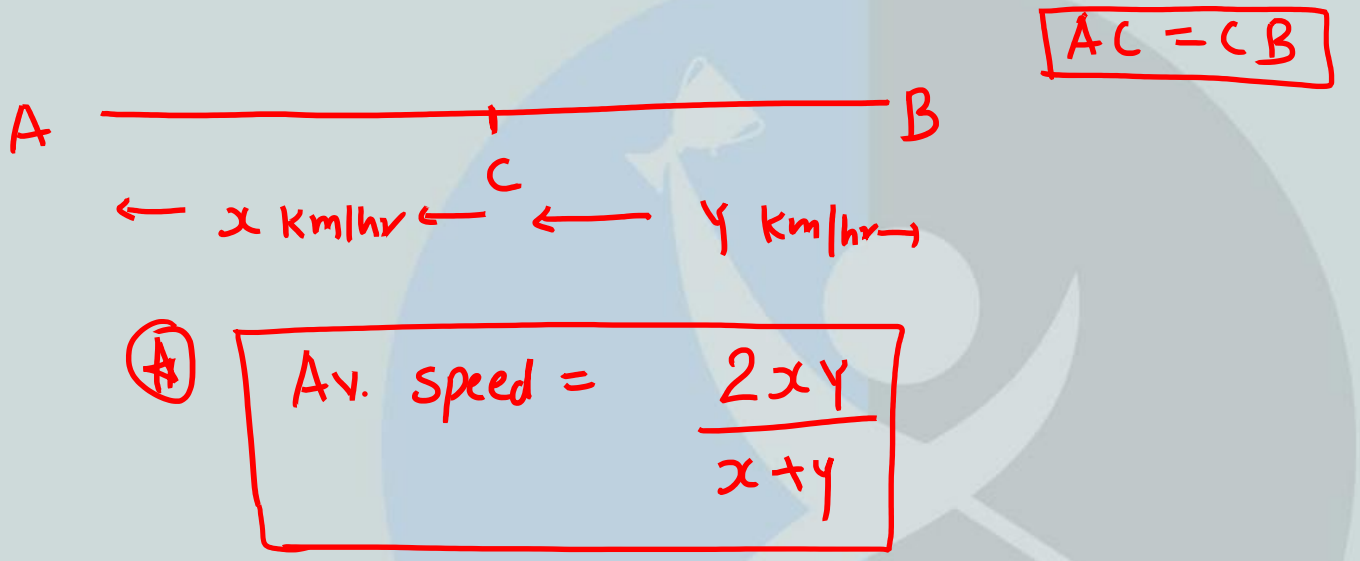
↓ km/hr or m/sec

$= \left[\dfrac{d_1 + d_2 + d_3}{t_1 + t_2 + t_3}\right]$

Av. speed $= \dfrac{10 + 20 + 30}{2 + 1 + 3}$

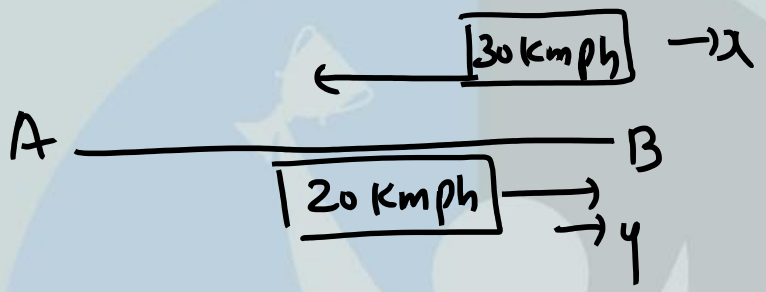
$= \dfrac{60}{6} = 10$ km/hr

Average speed when distances are equal:



(A) Av. speed = $\frac{2xy}{x+y}$

Q4. Rasid travels at a speed of 20 kmph from point A to point B and returns to point A at a speed of 30 kmph. Find his overall journey's average speed.



$$\text{Av speed} = \frac{2xy}{x+y} = \frac{2 \cdot 30 \cdot 20}{(20+30)} = \frac{40 \times 3\cancel{0}}{\cancel{5}0} = 24 \text{ kmph}$$

Q5. A man covers half of total distance with 12 km/h and another half distance with 24km/h. Find his average speed.

(a) 12 km/h
(b) 16 km/h
(c) 10 km/h
(d) 18 km/h

Av speed = $\frac{2 \times 12 \times 24}{36} = 16$ km/hr

Q6. Mohan flew from Delhi to Vizag via Mumbai. Flight speed was 600 km/hr from Delhi to Mumbai sector, while it was 1000km/hr from Mumbai to Vizag sector. Assuming the distance between Delhi-Mumbai and Mumbai-Vizag is the same, what was the average speed with which Mohan flew?

PYQ

1. 750 km/hr
2. 800 km/hr
3. 850 km/hr
4. 900 km/hr

$$\text{Av. speed} = \frac{2 \times 600 \times 1000}{1600} = \frac{2 \times 3 \times 250}{4} = 750 \text{ km/hr}$$

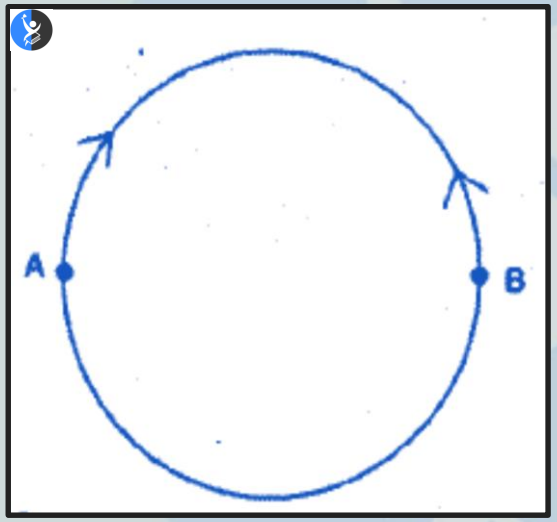
Q7. Mark covers a distance of D km at a speed of T km/hr. Then, he covers 2D km at half the speed. At what speed should he cover next 3D km so that average speed of entire journey is 0.8T km/hr (in km/hr)?

1) T
2) 1.2T
3) 0.9T
4) 0.72T

Q8. A peacock perched on the top of a 12 m high tree spots a snake moving towards its hole at the base of the tree from a distance equal to thrice the height of the tree. The peacock flies towards the snake in a straight line and they both move at the same speed. At what distance from the base of the tree will the peacock catch the snake?

(1) 16 m **(2)14 m**
(3)18 m **(4)12 m**

Q9. Two ants, initially at diametrically opposite points A and B on a circular ring of radius R, start crawling towards each other. The speed of the one at A is half of that of the one at B. The point at which they meet is at a straight line distance of :

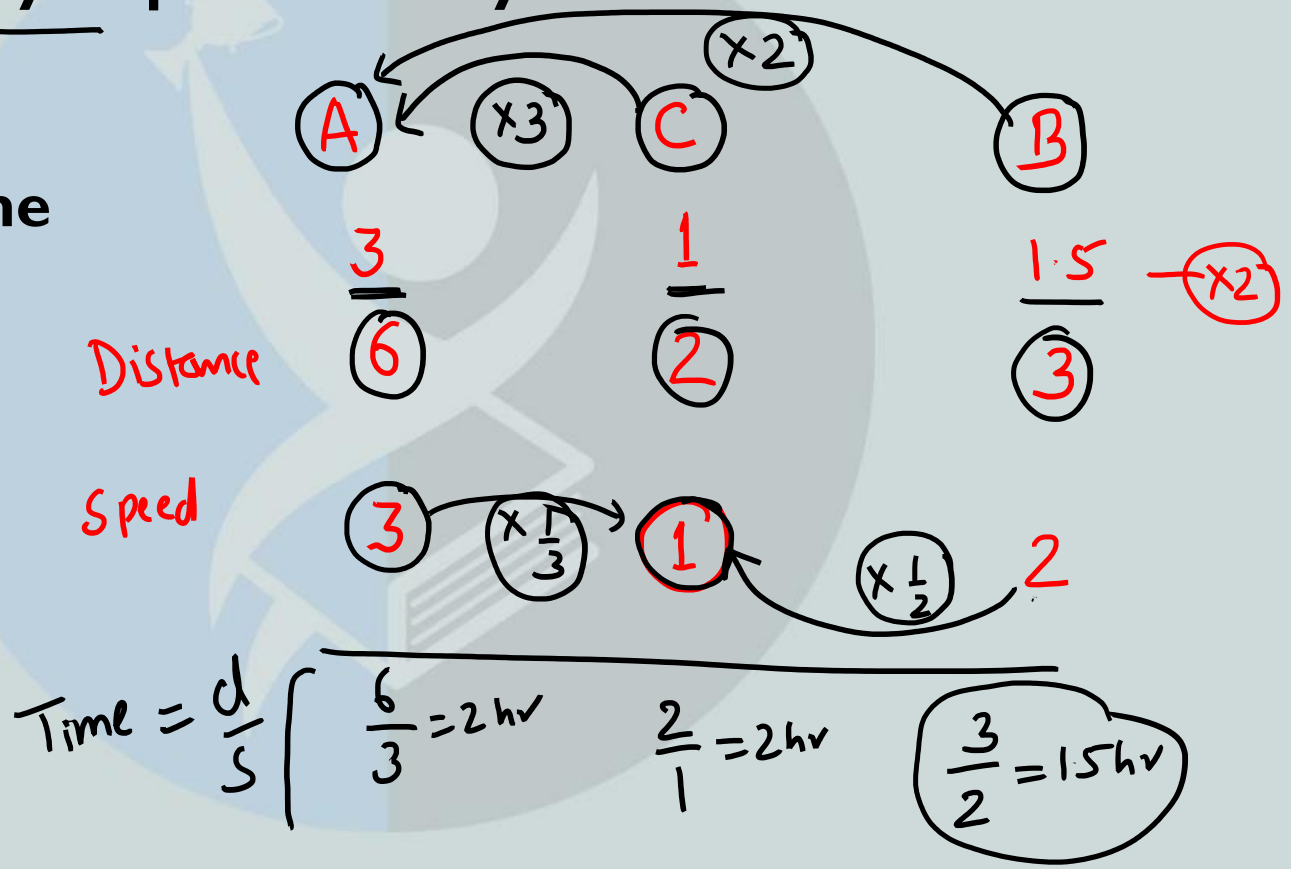


(1) R from A
(2) 3R/2 from A
(3) R from B
(4) 3R/2 from B

Q10. Abdul travels thrice the distance Catherine travels, which is also twice the distance that Binoy travels. Catherine's speed is 1/3 of Abdul's speed, which is also 1/2 of Binoy's speed. If they start at the same time then who reaches first?

PYQ

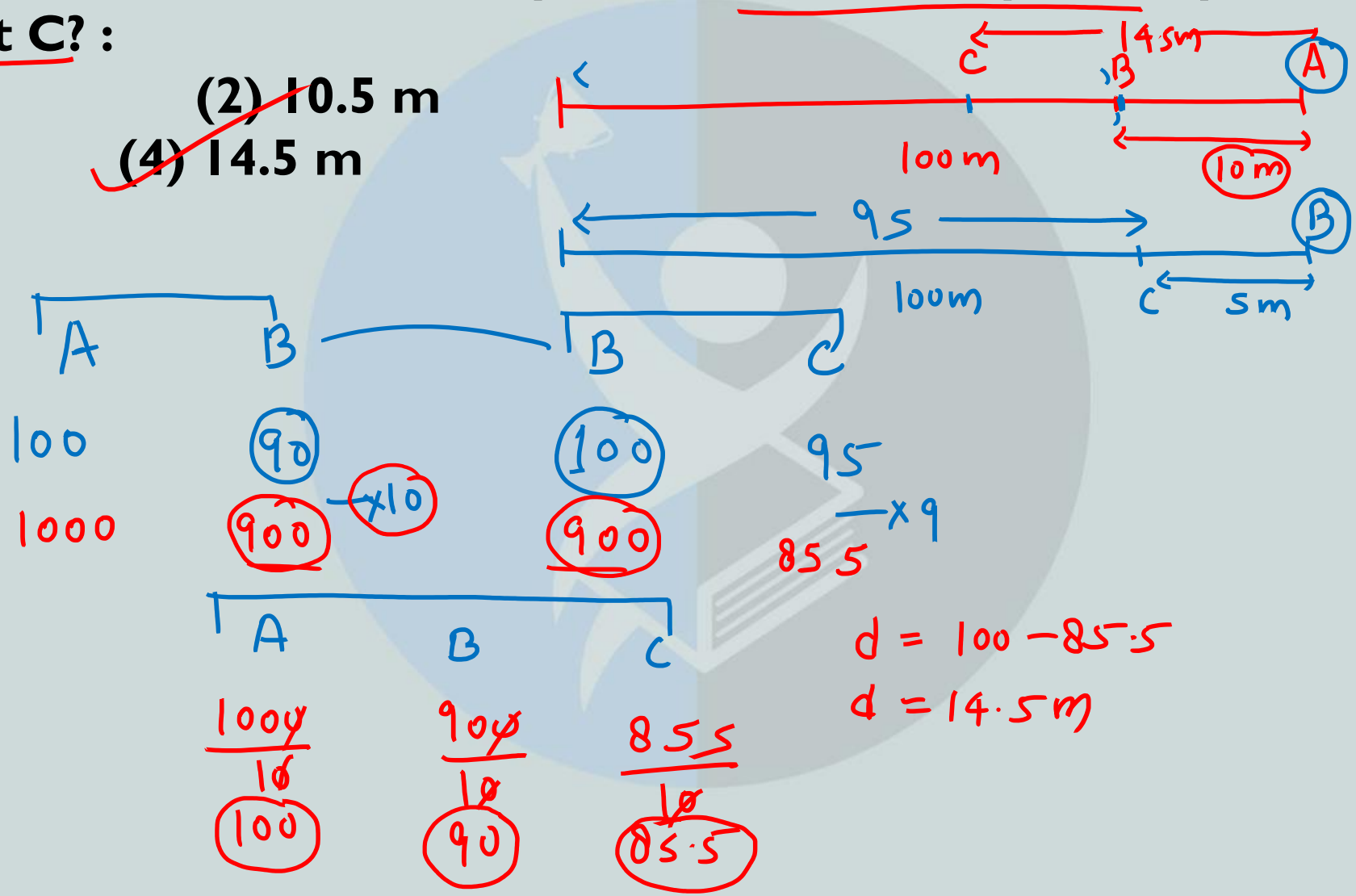
1) Both Abdul and Catherine
2) Binoy
3) Catherine
4) All three together



Q11. In a 100 m race A beats B by 10 m. B beats C by 5m. By how many meters does A beat C? :

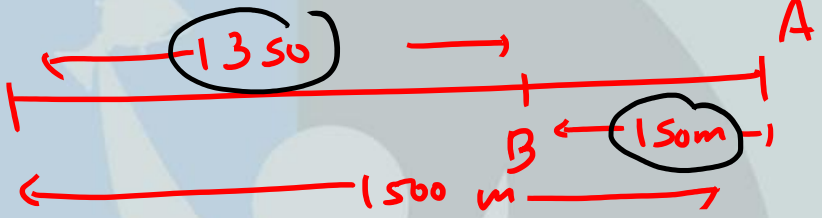
(1) 15.0 m **(2) 10.5 m**

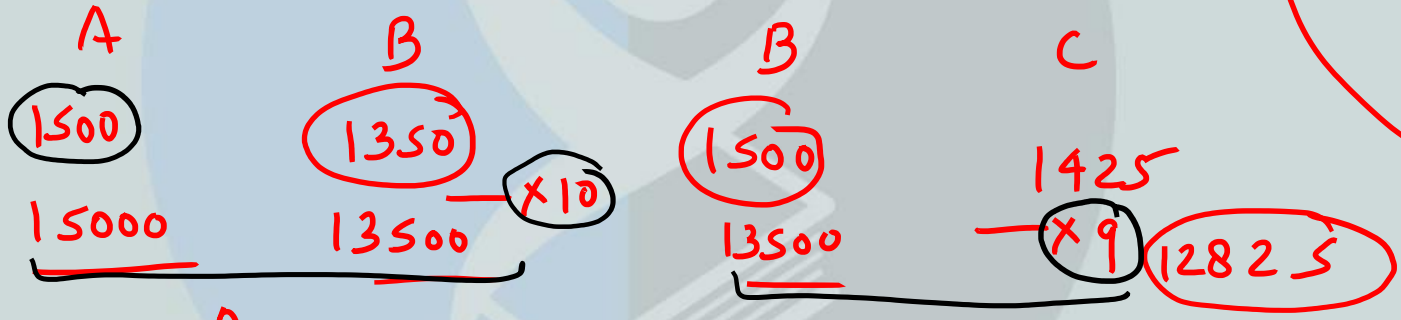
(3) 5.5 m **(4) 14.5 m**

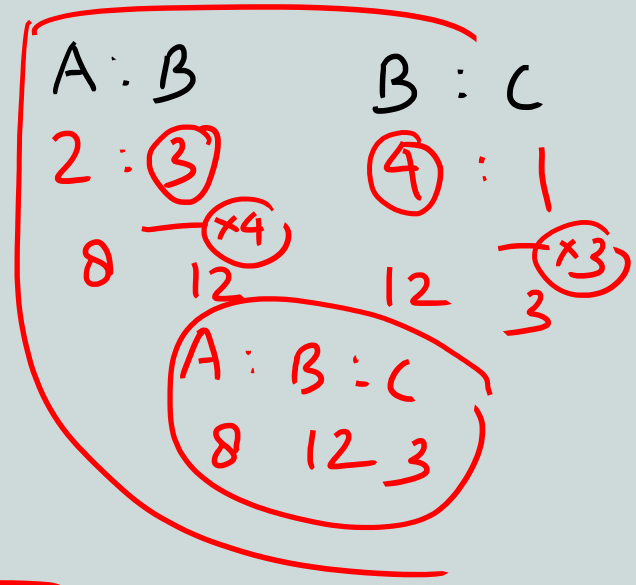


Q12. In a 1500 m race, Anil beats Bakul by 150 m and in the same race Bakul beats Charles by 75 m. By what distance does Anil beat Charles?

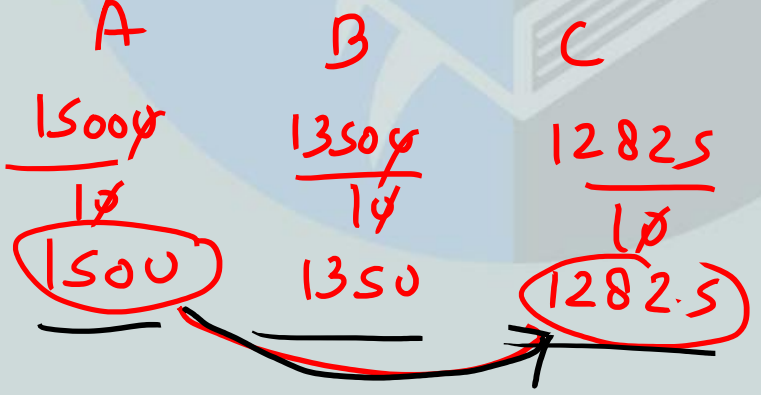
1. 217.50 m
2. 200.15 m
3. 293.50 m
4. 313.75 m







1500
1282.5
217.5



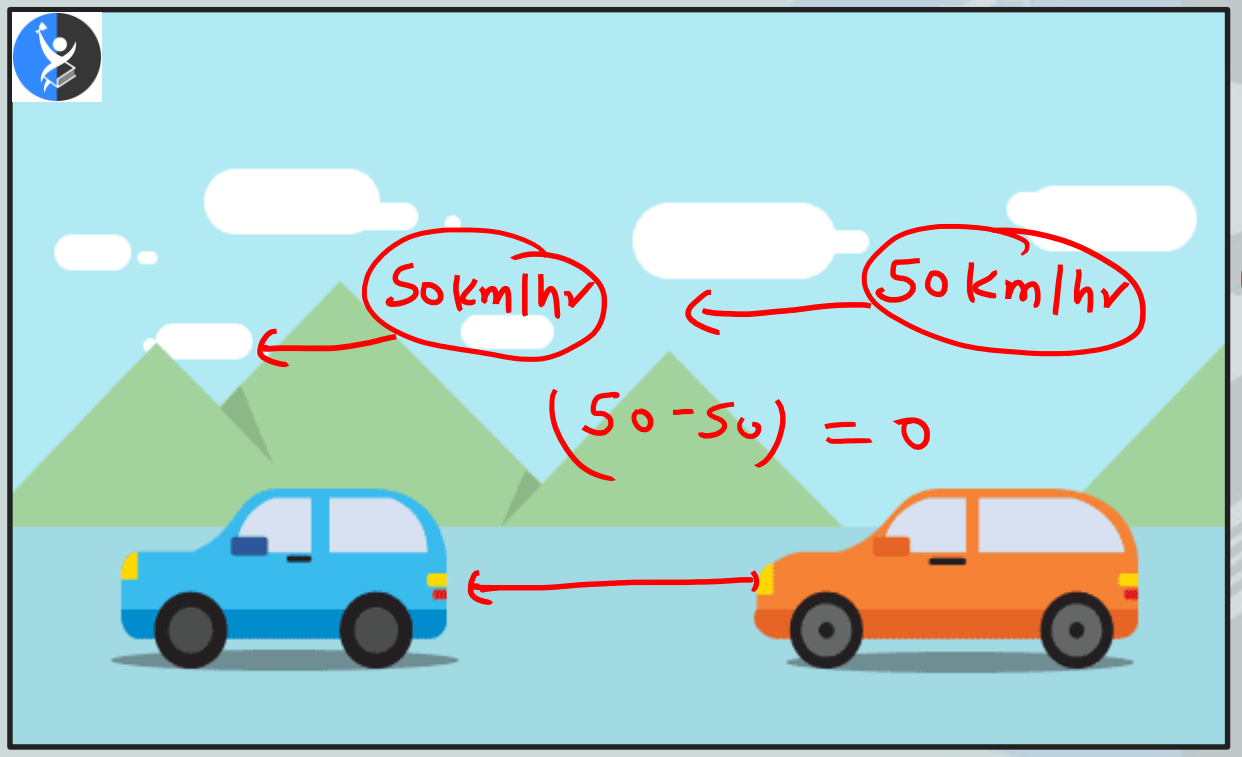
Q13. A cyclist covers a certain distance at a constant speed. If a jogger covers half the distance in double the time as the cyclist, the ratio of the speed of the jogger to that of the cyclist is

(1) 1:4 **(2) 4:1**
(3) 1:2 **(4).2:1**

Q14. A long-distance runner finds a water station after completing 1/7th of the total distance. After covering another 1/6th of the total distance he gets medical-aid. Another runner joins him 4 km after the medical-aid station. The second runner stops 4 km before the completion of run, covering 1/2 of the total distance. What is the total distance?

(1) 21 km (2) 30 km (3) 42 km (4) 50 km

Relative speed



① When objects are moving in same direction :-

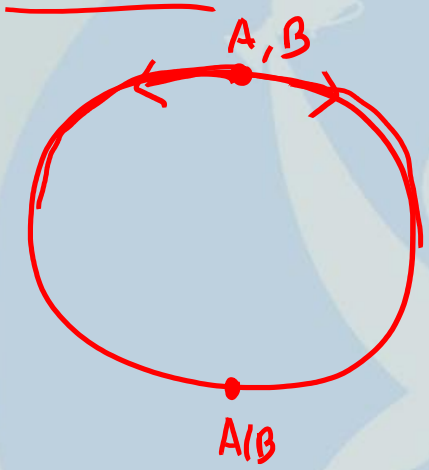
Relative speed = $(x-y)$ km/hr

② When objects are moving in opposite direction :-

Relative speed = $(x+y)$ km/hr

Q15. There are two persons A and B with a speed of 20 m/s and 10 m/s respectively, and length of the circular track is 1000 m. When will they meet for the first time anywhere on the track if they are running in opposite direction?

(1) 36.32 seconds
(2) 33.33 seconds
(3) 44. 23 seconds
(4) 38.36 seconds



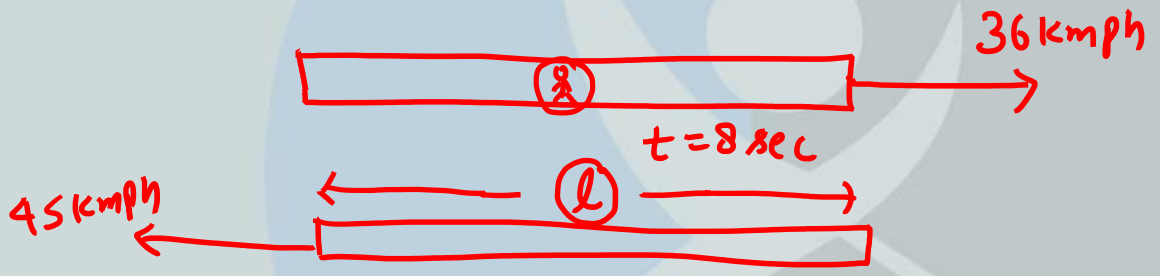
R speed = 20 + 10 = 30 m/sec

d = 1000 m

$t = \frac{d}{s} = \frac{1000}{30} = 33.33$ mps

Q16. Two Local trains travel in opposite directions at 36 kmph and 45 kmph and a man sitting in slower train passes the faster train in 8 seconds. The length of the faster train is

(a) 80 m (b) 100 m (c) 120 m (d) 180 m



$d = l$

$t = 8$ sec

R.Speed $= (36 + 45)$ kmhr $= 9 \times \frac{5}{18} = \frac{45}{2}$ mps

$d = S \times t$

$d = \frac{45}{2} \times 8^{4}$

$d = 180$ m

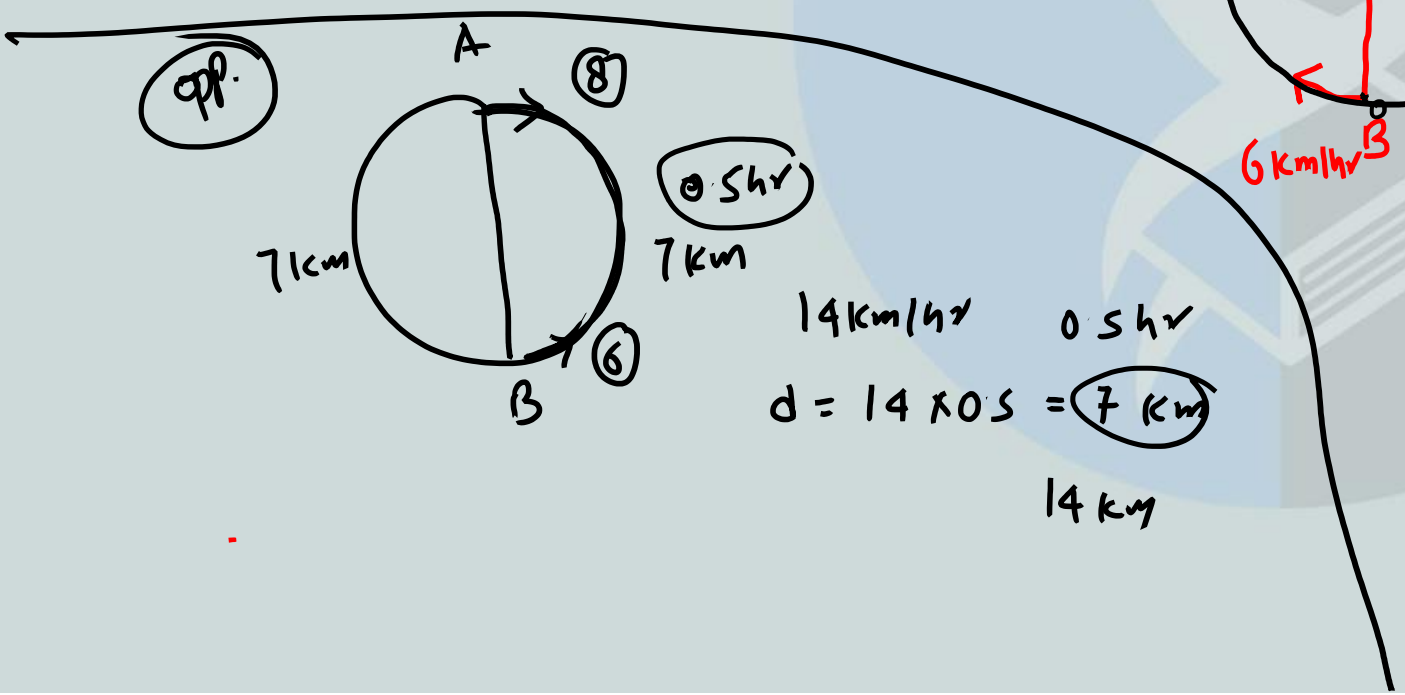
Q17. A tiger is 50 leaps of its own behind a deer. The tiger 5 leaps per minute to the deer is 4. If the tiger and the deer cover 8 meter and 5meter per leap respectively, what distance in meters will the tiger have to run before it catches the deer?

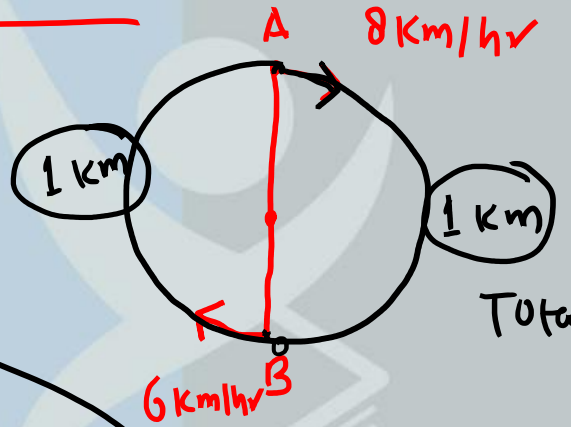
1) 200
2) 400
3) 600
4) 800

Q18. Two runners A and B start running from diametrically opposite points on a circular track in the same direction. If A runs at a constant speed of 8 km/h and B at a constant speed of 6 km/h and A catches up with B in 30 minutes, what is the length of the track?

IPYQ

(1) 1 km (2) 4 km
(3) 3 km (4) ~~2 km~~

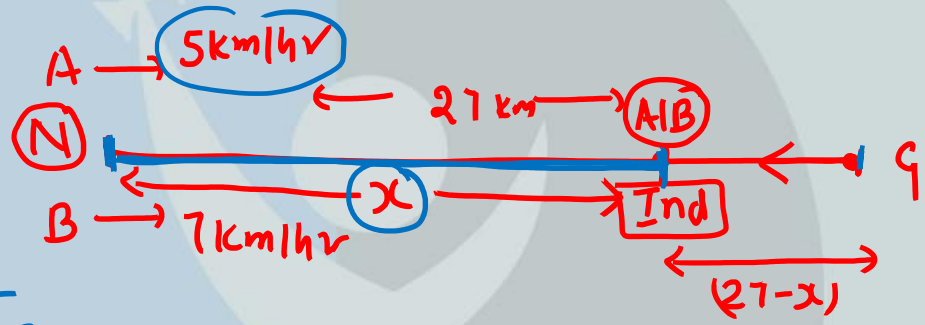




R.speed = (8-6) = 2 km/hr
t = 30 min. = 0.5 hr
d = 2 x 0.5 = 1 km
Total length = 1+1 = 2 km

Q19. The distance from Nehrunagar to Gandhinagar is 27 km. A and B start walking from Nehrunagar towards Gandhinagar at speeds of 5 km/hr and 7 km/hr, respectively. B reaches Gandhinagar, returns immediately, and meets A at Indiranagar. What is the distance between Nehrunagar and Indiranagar? (assume all three cities to be in one straight line) :

(1) 12.5 km
(2) 22.5 km
(3) 4.5 km
(4) 13.5 km



$t = \frac{d}{s}$

$T_A = T_B$

$\frac{x}{5} = \frac{(27+27-x)}{7}$

$7x = 5[54-x]$

$7x = 270 - 5x$

$12x = 270$

$x = 22.5$ km

Q20. Two locomotives are running towards each other with speeds of 60 and 40 km/hr. An object keeps on flying to and fro from the front tip of one locomotive to the front tip of the other with a speed of 70 km/hr. After 30 minutes, the two locomotives collide and the object is crushed. What distance did the object cover before being crushed?

(1) 50 km **(2) 45 km**

(3) 35 km **(4) 10 km**

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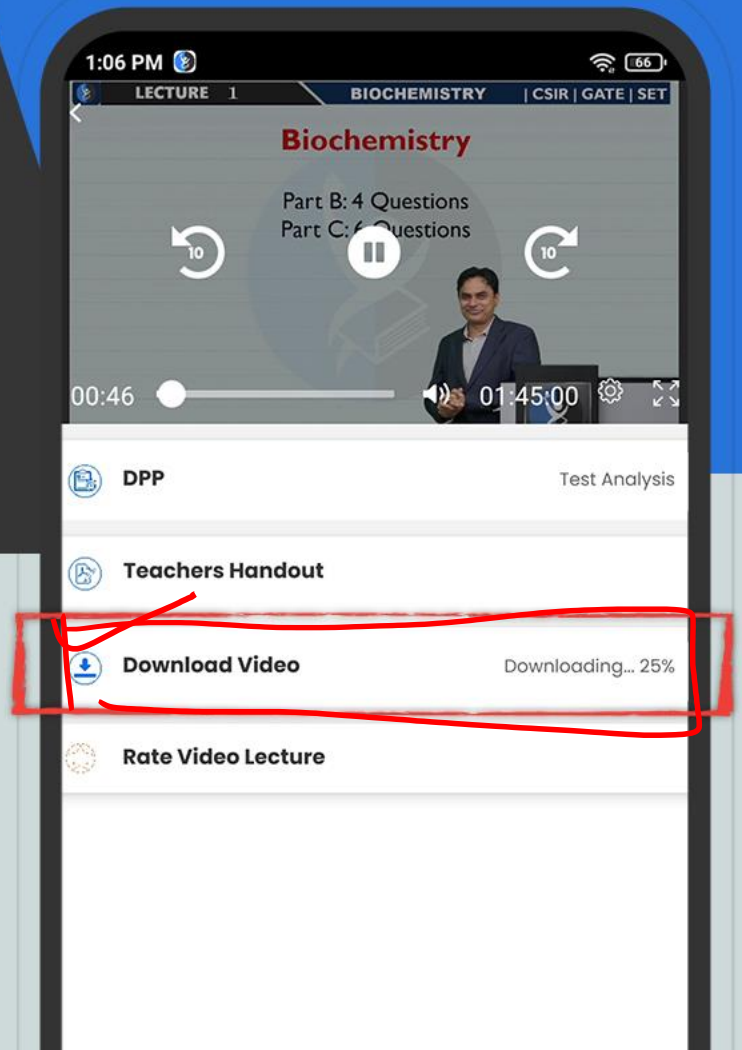

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